Implementing Automated Data Flows

Part 1
General Overview

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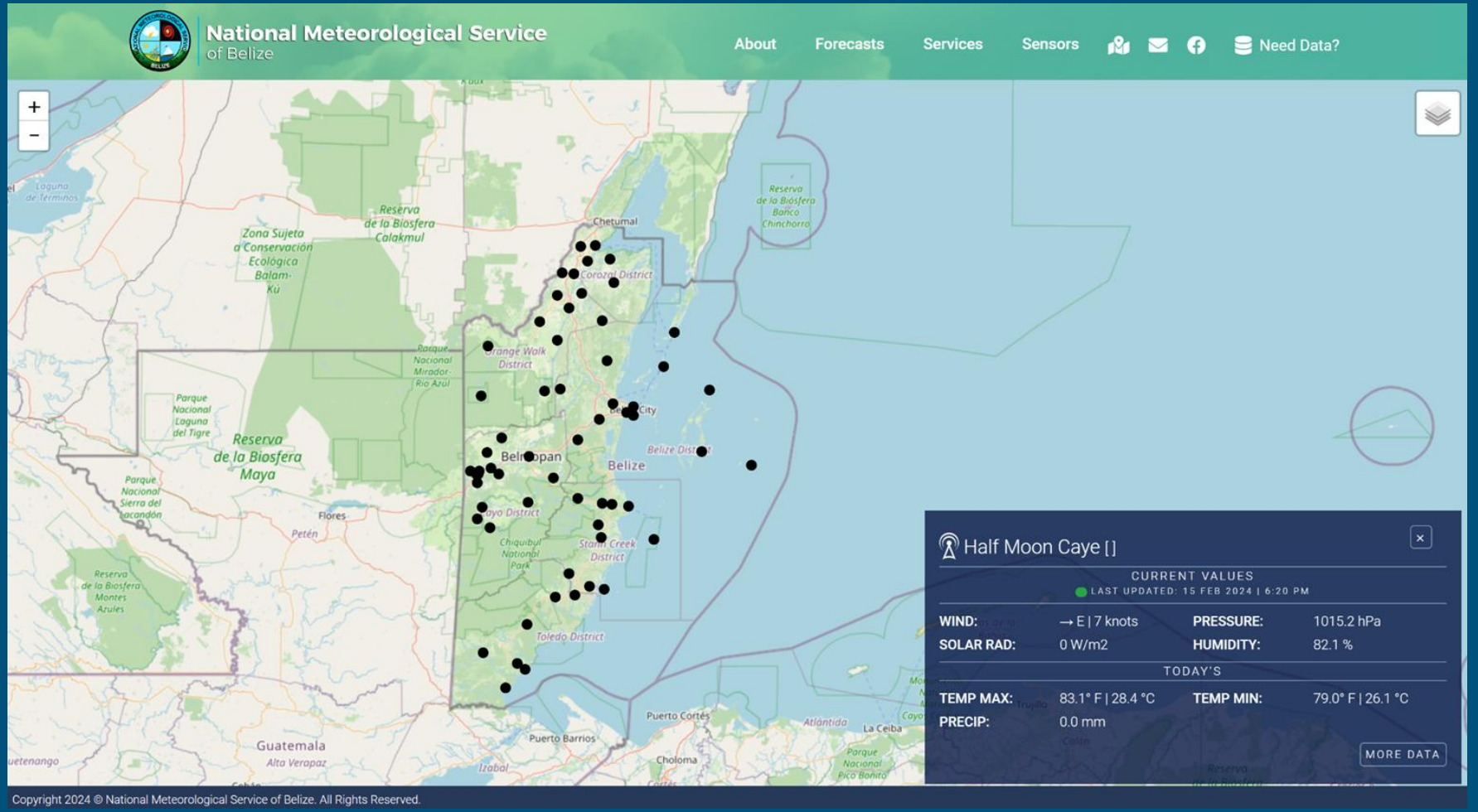
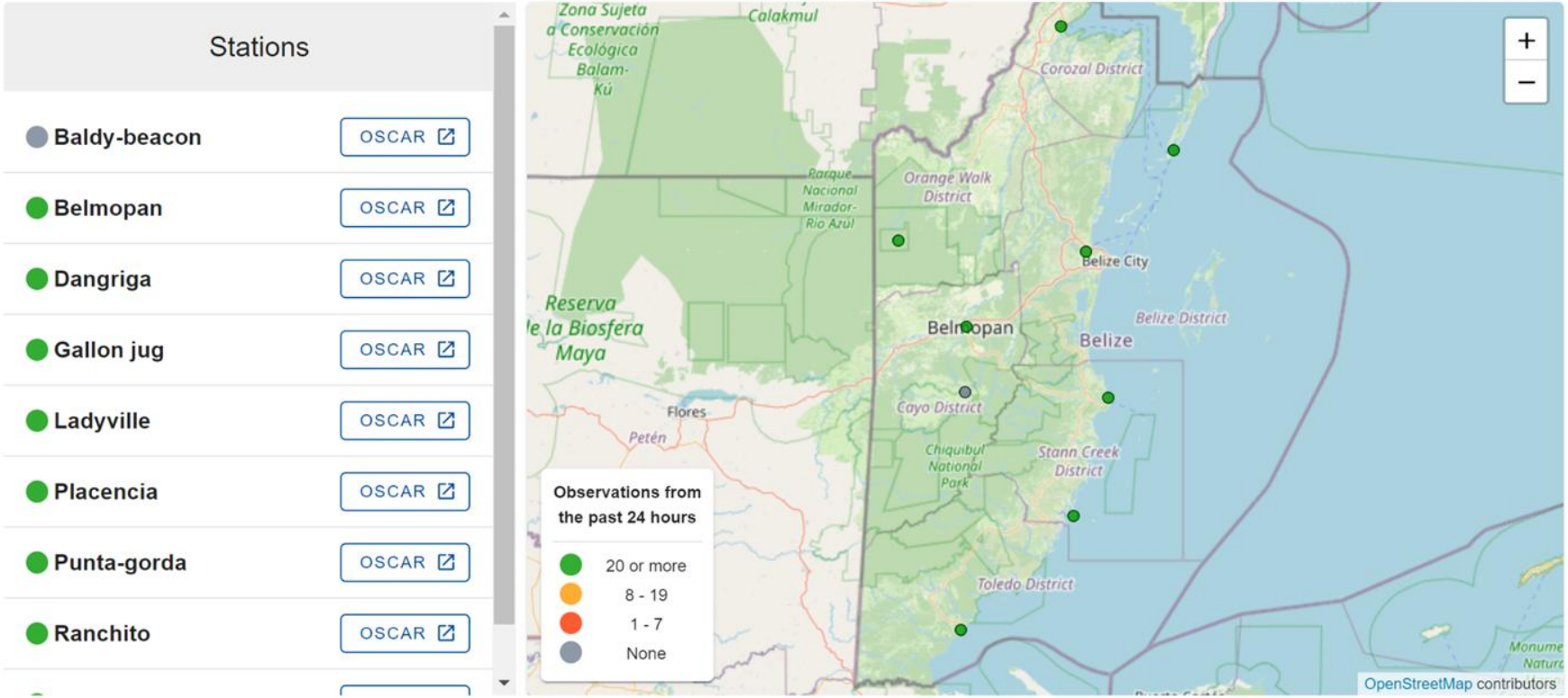
How is data displayed here? - https://nms.gov.bz



https://wis.nms.gov.bz

HOME | DOCUMENTATION



Things to Consider when automating?

Map out each stage the data moves, what needs to be done at each stage

- How does the weather station operate and take measurements?
- Is it a flow of live data or stored as intervals?
- What data format is used?
- How is data transmitted?
- Does the data format change during transmission?
- Where does the data go?
- Is the data appended in one file, or are individual files created for each Observation?
- Do you need to download it from a server?
- Do you need software to download the data?
- Where will the downloaded data be stored?
- Can it be ingested into a database?
- What kind of database do you have?
- Does it handle high frequency time series data well?
- How will data move from one stage to the next?
- How will files be backed up, archived, moved, copied along the data flow?

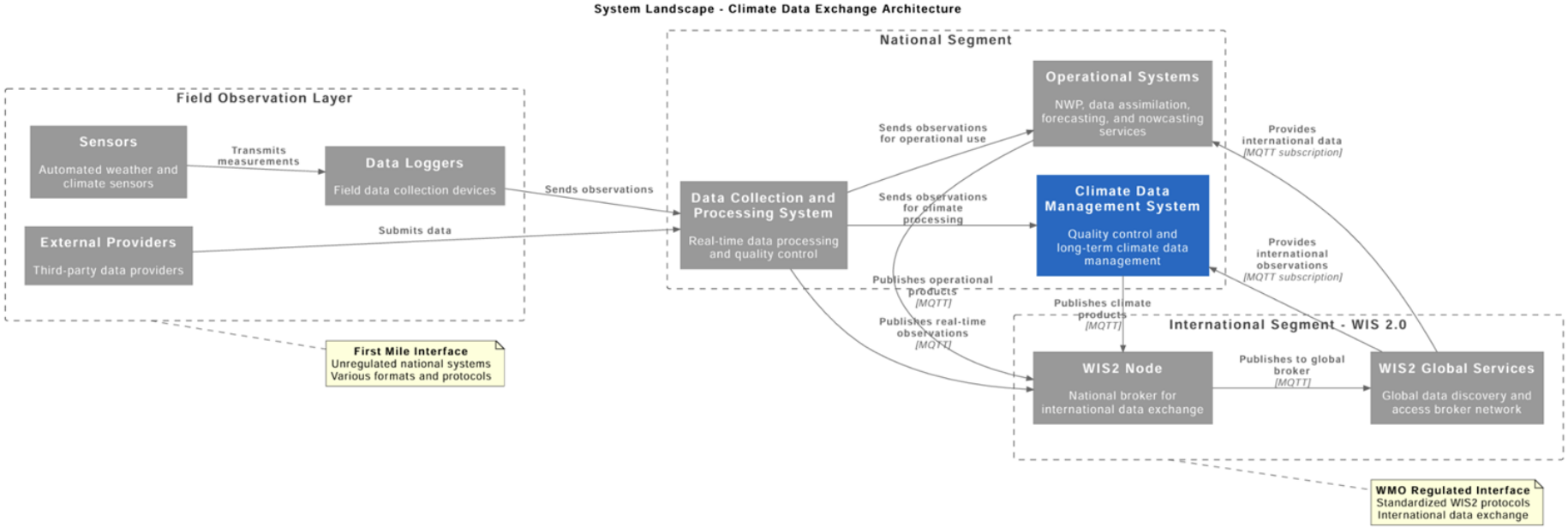
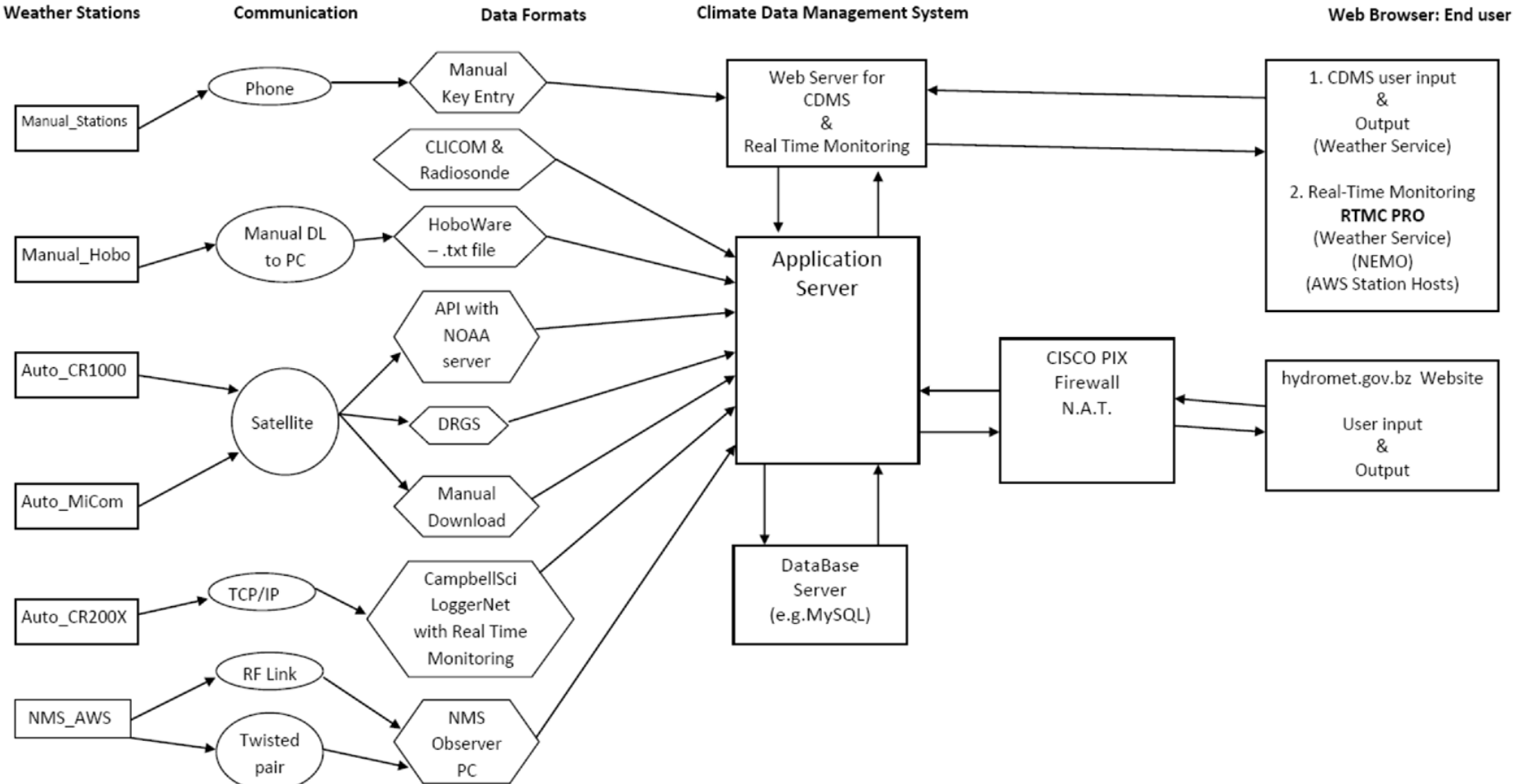

System Landscape - Climate Data Exchange Architecture
Field Observation Layer
Sensors
Automated weather and climate sensors
Transmits measurements
Data Loggers
Field data collection devices
Sends observations
External Providers
Third-party data providers
Submits data
First Mile Interface
Unregulated national systems
Various formats and protocols
National Segment
Data Collection and Processing System
Real-time data processing and quality control
Sends observations for operational use
Sends observations for climate processing
Operational Systems
NWP, data assimilation, forecasting, and nowcasting services
Climate Data Management System
Quality control and long-term climate data management
Provides international data [MQTT subscription]
Provides international observations [MQTT subscription]
Publishes operational products [MQTT]
Publishes real-time observations [MQTT]
Publishes climate products [MQTT]
International Segment - WIS 2.0
WIS2 Node
National broker for international data exchange
Publishes to global broker [MQTT]
WIS2 Global Services
Global data discovery and access broker network
WMO Regulated Interface
Standardized WIS2 protocols
International data exchange

Figure 1.1

Belize Weather Station Network (BWSN) Overview



Main parts of Observation Network

1. In-Situ and Remote Sensing
   - *Weather stations(Manual and Automatic), Radar, Lightning & Satellite*
   - *Sensors & Other Accessories - Panels, batteries, mounts, masts etc*
2. Data Transmission
   - *Satellite DCPs, Mobile, TCP/IP, RF, Manual download*
   - *Modems & Accessories*
3. Data Reception
   - *How will raw data be collected, archived & sent to Database*
   - *Monitoring data reception*
4. Data Storage and processing
   - *Where will data be sent once received? How will it be processed?*
   - *QC checks; Metadata for stations and sensors*
5. Data output and display
   - *Message outputs - SYNOP, METAR, CLIMAT, ATIS*
   - *RTMC Pro, Climate Data Management System(CDMS), NMS Website*

Data Flow

AWS(Data logger) (Stage 1)

Raw Data Storage (Stage 2)

CDMS - Data Processing (Stage 3)

Data Output - Display/Access/Transmission(Stage 4)

Challenges and Recommendations

Stage 1(AWS) - Challenges/Recommendations

- Currently there is no recommended standard for data logger operation
- There are multiple manufacturers, users and stakeholders of weather data; but there is no standard for data logger operation.

  a. Different sample rate for each variable
  b. Different computations done on each variable
  c. Some do QC checks at the data logger others dont
  d. Different storage intervals

- Each manufacturer does things differently

- NMHSs must be aware and understand differences and do what they can to standardize if possible.

Stage 2 - Challenges/Recommendations
Data Reception and Storage

- There are many technological ways to handle data reception and storage.
- More established NMHSs can help smaller NMHS's who have not really thought through these issues.

For example - As you face a data flow/automation problem:

- Does your solution follow best practice?
- Is there a more efficient/secure method of doing "this"?
- What are other NMHSs doing?
- How can we share experiences, help and learn each other?
- What is the most cost effective tech stack to handle this kind of workload
- Do AWS manufacturers provide a way for data files to be sent to NMHSs?
    - Free, 1 time payment, continual subscription
    - Proprietary or non-Proprietary
    - What protocols are used for data transfers?
- Do NMHS's know how to ingest AWS satellite data via NOAA LRGS or NOAA DADDS

Stage 3 CDMS/Database - Challenges/Recommendations

1. NMHSs should have a database/CDMS where AWS data can be ingested and where additional quality control checks can be done before any distribution of the data.

2. The CDMS/Database should be the only source of truth, from which all other data flows and is accessed.
    - WIS2box
    - Hourly messages
    - Daycli
    - CLIMAT messages
    - Stakeholders
    - Websites
    - Etc

3. The CDMS should:
    - Be accessible - e.g. web application
    - Be able to Ingest from multiple data sources
    - Conduct Automatic QC procedures
    - Allow for user friendly setup and configuration
    - Should be able to generate the necessary WMO messages from stored data and have it sent on GTS/WIS 2.0
    - See WMO No. 1131 for CDMS spec and Functional/Non-Functional Requirements

Stage 4 Data Access - Challenges/Recommendations

1. Database should be able to push data unto WIS 2.0/wis2box

1. Database should use modern API for data sharing and access

1. NMHS should have data sharing policies established

The END
Of Part 1

QUESTIONS